Claims:

1. A fuel cell, comprising:

(A) an anode comprising a catalyst phase and receiving a liquid fuel from a liquid fuel source substantially through diffusion;

(B) an electrolyte component having a first surface adjacent to said anode; and

(C) a cathode adjacent to a second surface of said electrolyte component;

wherein said anode is provided with a heating environment to at least partially vaporize said liquid fuel inside said anode near said catalyst phase which operates to ionize said fuel in a vapor or vapor-liquid mixture form to produce protons and electrons.

2. The fuel cell according to claim **1**, wherein said catalyst phase forms a thin layer adjacent to said electrolyte component.

3. The fuel cell according to claim **1**, wherein said heating environment receives heat resulting from the inherent electrochemical reactions of the fuel cell.

4. The fuel cell according to claim **1**, wherein said heating environment receives heat from joule heating by passing a current through said anode at or near said anode catalyst phase.

5. The fuel cell according to claim **1**, wherein said anode comprises a porous fuel-permeating material in fluid communication with said liquid fuel source.

6. The fuel cell according to claim **5**, wherein said fuel-permeating material exhibits a capillary phenomenon, and is configured to receive said liquid fuel from said source by a capillary force.

7. The fuel cell according to claim **5**, wherein the porous fuel-permeating material is selected from the group consisting of porous materials, cottons, papers, non-woven fabrics, and woven fabrics which produce a capillary action.

8. The fuel cell according to claim **7**, wherein the porous material is one which has a pore volume

of 20 to 90% and a pore diameter of 0.01 to 150 μm.

9. A fuel cell, comprising:

(A) a first power generating section and a second power generating section, which are placed on top of the other with a separator interposed therebetween;
said first power generating section being composed of a first anode, a first electrolyte plate, and a first cathode, which are placed sequentially one over another;
said second power generating section being composed of a second anode, a second electrolyte plate, and a second cathode, which are placed sequentially one over another; and

(B) a liquid fuel passage formed adjacent to both of said first and second power generating sections and configured to supply said first and second anodes with said liquid fuel through said liquid fuel passage;

wherein said first anode and said second anode are each provided with a heating environment to at least partially vaporize said liquid fuel inside said anodes and said anodes each further comprises a catalyst phase to ionize said fuel in a vapor or vapor-liquid mixture form to produce protons and electrons.

10. The fuel cell according to claim **9**, wherein said first anode and said second anode each comprises a fuel-permeating material in flow communication with said liquid fuel passage.

11. The fuel cell according to claim **9**, wherein the separator has oxidant gas feeding channels in its surface.

12. The fuel cell according to claim **10**, wherein the separator has liquid fuel feeding grooves formed in its surface which is in contact with the fuel permeating material of said first anode.

13. The fuel cell according to claim **10**, wherein the fuel permeating material of said first anode has a capillary action greater than that of the liquid fuel passage.

14. The fuel cell according to claim **9**, wherein said catalyst phase forms a thin layer adjacent to said electrolyte plate.

15. The fuel cell according to claim **9**, wherein said heating environment receives heat resulting from the intrinsic electrochemical reactions of the fuel cell.

16. The fuel cell according to claim **9**, wherein said heating environment receives heat from joule heating by passing a current through said first anode and/or said second anode.

17. The fuel cell according to claim **10**, wherein the fuel-permeating material is selected from the group consisting of porous materials, cotton, papers, non-woven fabrics, and woven fabrics which produce a capillary action.

18. A fuel cell, comprising:

(A) a cathode;

(B) an electrolyte plate disposed on said cathode;

(C) an anode disposed on said electrolyte plate and configured to be supplied with a liquid fuel; and

(D) a liquid fuel holding portion disposed on said anode to supply liquid fuel thereto;

wherein said anode is provided with a heating environment to at least partially vaporize said liquid fuel inside said anode and said anode further comprises a catalyst phase to ionize said fuel in a vapor or vapor-liquid mixture form to produce protons and electrons.

19. The fuel cell according to claim **18**, wherein said catalyst phase forms a thin layer adjacent to said electrolyte plate.

20. The fuel cell according to claim **18**, wherein said heating environment receives heat resulting from the electrochemical reactions of the fuel cell.

21. The fuel cell according to claim **18**, wherein said heating environment receives heat from joule heating by passing a current through said anode.

22. The fuel cell according to claim **18**, wherein said anode comprises a porous fuel-permeating material in fluid communication with said liquid fuel holding portion.

23. The fuel cell according to claim **22**, wherein said fuel-permeating material exhibits a capillary phenomenon, and is configured to receive said liquid fuel from said liquid fuel holding portion by a capillary force.

24. The fuel cell according to claim **22**, wherein the porous fuel-permeating material is selected from the group consisting of porous materials, cotton, papers, non-woven fabrics, and woven fabrics which produce a capillary action.

25. The fuel cell according to claim **1**, further comprising a temperature sensor to monitor the fuel temperature at or near said catalyst phase.

26. The fuel cell according to claim **25**, further comprising a temperature control device to regulate the fuel temperature near or at said catalyst phase.

27. The fuel cell according to claim **9**, further comprising a temperature control device to monitor and regulate the fuel temperature at or near the catalyst phase in at least one of said first anode and second anode.

28. The fuel cell according to claim **18**, further comprising a temperature control device to monitor and regulate the fuel temperature at or near said catalyst phase.

29. A fuel cell, comprising:

(A) an anode comprising a catalyst phase and receiving a liquid fuel from a liquid fuel source, said liquid fuel having a minimum boiling point $T_b(min)$ and a maximum boiling point

T_b(max);

(B) an ion exchange electrolyte having a first surface adjacent to said anode; and

(C) a cathode adjacent to a second surface of said electrolyte;

wherein said anode is provided with a heating environment inside said anode so that said catalyst phase operates at a temperature between T_b(min) and T_b(max) + 50 degrees Centigrade to ionize said fuel to produce ions that move across said ion exchange electrolyte.

30. The fuel cell according to **29**, wherein said liquid fuel comprises a mixture of water with a boiling point of 100°C and an alcohol selected from the group consisting of methanol with a boiling point of approximately 64°, ethanol with a boiling point of approximately 78.5°C, and combinations of both methanol and ethanol.